Remarks

Amendments to the Claims

Claim 1 has bee amended to limit the recited elastomers to isoprene-butadiene rubber, synthetic polyisoprene rubber, and metal coupled elastomers. Claim 2 has been amended to limit the recited elastomers to isoprene-butadiene rubber and synthetic polyisoprene rubber.

Claims 12 and 16 have been amended to better define the term "starch/plasticizer composite." and to include ultra high molecular weight polyethylene. Support is found at page 9 line 32 to page 10 line 3.

Claims 21-24 have been added to better define what Applicants regard as the invention.

Rejections Under 35 U.S.C. Section 112

Claim 16 is rejected under 35 U.S.C. 122 as being indefinite. Claim 16 has been amended to recite a plasticized starch composite filler. Applicants urge that claim 16 is now clear.

Rejections Under 35 U.S.C. Section 102/103

Claims 1-10 and 12-20 are rejected under 35 U.S.C. 102(b) as anticipated by, or in the alternative (including claim 11) under 35 U.S.C. 103(a) as being unpatentable over Kang et al., U.S. Patent No. 5,260,370. To the extent that the amended claims are deemed unpatentable over these references, the rejections are traversed.

Kang et al. is directed to oil extended elastomers and compounds thereof. The elastomers are disclosed to include copolymers of 1,3 conjugated dienes and aromatic vinyl compounds (column 2, lines 29-33; column 4 lines 5-60). Thus all elastomers disclosed by Kang are derived from monomers necessarily including aromatic vinyl compounds such as styrene. Nowhere does Kang et al teach nor suggest use of isoprene-butadiene rubber or synthetic polyisoprene. Further, nowhere does Kang et al teach nor suggest metal-coupled elastomers.

Applicants urge that the claims as amended are not anticipated by Kang et al. As to isoprene-butadiene rubber and synthetic polyisoprene rubber, Kang et al clearly requires the presence of aromatic vinyl compounds in the copolymer; isoprene-butadiene rubber and synthetic polyisoprene do not contain aromatic vinyl moieties. Kang et al therefore excludes isoprene-

butadiene rubber and synthetic polyisoprene rubber and does teach these limitations.

As to metal-coupled elastomers, the Examiner states that silicon- or tin-coupled rubbers are inherently possessed in Kang et al, alternatively since Kang et al discloses "coupling agents" or due to the presence of the anionic polymerization catalyst employed. Applicants urge respectfully that the Examiner is in error, and that elastomers having "coupling agents" and/or anionic polymerization catalysts of Kang et al do not equate to metal-coupled elastomers of the present claims. The coupling agents of Kang et al. refer to rubber-to-filler coupling agents added as a rubber compounding additive, while in contrast the metal coupling agents of the present invention refers to agents added during polymerization to affect polymer structure. As noted in the present specification at page 4, lines 17-26, in the present invention, the rubber polymers which are prepared by anionic polymerization may be coupled with a suitable coupling agent, such as a tin halide or a silicon halide, to improve desired properties. For example, tin-coupled polymers are known to improve treadwear and to reduce rolling resistance when used in tire tread rubbers. Such tin-coupled rubbery polymers are typically made by coupling the rubbery polymer with a tin coupling agent at or near the end of the polymerization used in synthesizing the rubbery polymer. In the coupling process, live polymer chain ends react with the tin coupling agent, thereby coupling the polymer. For instance, up to four live chain ends can react with tin tetrahalides, such as tin tetrachloride, thereby coupling the polymer chains together. By contrast, the coupling agents disclosed by Kang et al (at column 15 line 40) refers to rubber compounding additives such as sulfur-containing organosilicon compounds added to the rubber during rubber compounding to facilitate coupling between the rubber and fillers; such rubber to filler coupling agents are disclosed in the present specification at page 16 lines 5-6. One skilled in the art would readily distinguish the coupling agents of Kang et al (used to couple rubbers with fillers) from agents used to metal-couple elastomers; examples include tin halides and silicon halides. Applicants therefore urge that Kang et al does not teach metal-coupled elastomers.

Applicants urge that as Kang et al does not teach isoprene-butadiene rubber, synthetic polyisoprene rubber, or metal-coupled elastomers, Kang et al does not anticipate the present claims.

Applicants further urge that the claims are not obvious over Kang et al. Nowhere does Kang et al. suggest to one skilled in the art to use or substitute isoprene-butadiene rubber, synthetic polyisoprene rubber, or a metal-coupled elastomer for the copolymers of Kang et al, which must include aromatic vinyl compounds. Applicants urge therefore that no prima facie obviousness exists for any of the claims. Applicants further urge that even if prima facie obviousness exists, the present specification includes evidence of unexpected results sufficient to overcome obviousness.

Applicants urge that in light of the evidence of unexpected results disclosed in the specification, claim 1 is fully patentable over the cited art. As shown in Examples 1, 2 and 3, elastomers extended with low PCA oils such as TDAE, MES, and heavy naphthenic oils show significantly lower degradation of Mooney viscosity as compared with elastomers extended with conventional DAE aromatic oil. In particular, Examples 1 and 2 show that non-metal coupled isoprene butadiene rubbers (IBR) extended with MES or TDAE oil show much lower decrease in Mooney viscosity after aging than did IBR extended with conventional DAE oil (Tables 2 and 5). Further, Example 3 shows that tin-coupled IBR extended with TDAE or MES oil shows much lower decrease in Mooney viscosity after aging that did tin-coupled IBR extended with convention DAE oil (Tables 7 and 8). The lower reduction in Mooney viscosity on aging is significant because it indicates that the isoprene-containing elastomers extended with low PCA oils do not degrade nearly as much as those extended with conventional DAE oil. This lower degradation is desirable as it indicates that, in the case of non-coupled elastomers, that the polymer chains are not broken to as great a degree, and in the case of metal-coupled elastomers, the metal-chain bonds are not broken to as great a degree. The less degraded, longer chain elastomers maintained upon extension with low PCA oils are desirable for use in tires due to their superior hysteretic behavior as compared with the

more degraded, lower molecular weight elastomers extended with conventional oil. Such behavior of the extended elastomers is unexpected; prior to the present invention it has proven difficult to extend IBR, IR, and metal-coupled elastomers with conventional oils without unacceptable degradation of the elastomers. It is only in the present invention that the unexpected benefit of lowered degradation that the use of low PCA oils in these elastomers is appreciated.

Applicants urge that claims 2 and 21 are fully commensurate with the showing of unexpected results and are therefore fully patentable over the cited art. Claim 2 recites that the solution polymerized elastomer is selected from the group consisting of isoprene-butadiene rubber (IBR), and synthetic polyisoprene rubber (IR). It is the presence of isoprene in the elastomer that makes difficult the extension of these elastomers with conventional oils. While the Examples show the effect of oil extension on IBR, one skilled in the art would fully expect based on these results that a similar behavior will be seen for IR. Claim 21 recites that the solution polymerized elastomer is isoprene-butadiene rubber (IBR). Examples 1 and 2 clearly illustrate the effect of oil extension with low PCA oils on IBR. For these reasons, Applicants urge that claims 2 and 21 are fully patentable over the cited art in view of the unexpected results.

Applicants further urge that claims 3, 4, 23 and 24 are fully commensurate in scope with the showing of unexpected results and are therefore fully patentable over the cited art.

Claim 3 recites that the solution polymerized elastomer is metal-coupled, and claim 4 recites that the solution polymerized elastomers is selected from the recited group. In these elastomers, it is the presence of metal-elastomer bonds and isoprene in the elastomer that makes difficult the extension of these elastomers with conventional oils. While Example 3 shows the effect of oil extension on tin-coupled IBR, one skilled in the art would fully expect based on these results that a similar behavior will be seen for other metal coupled, isoprene containing elastomers; the showing of unexpected results is therefore fully commensurate in scope with claims 3 and 4 and claims 3 and 4 are fully patentable over the cited art

Claim 23 recites that the solution polymerized elastomer is tin- or silicon-coupled

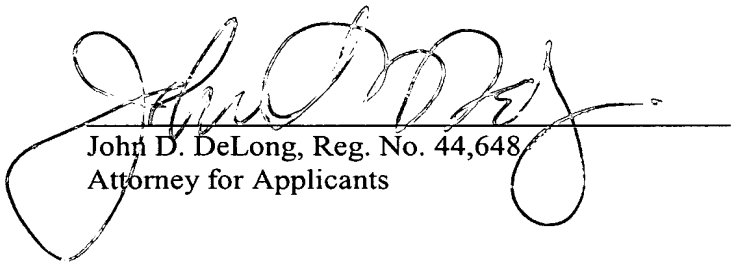
isoprene-butadiene rubber (IBR). Example 3 clearly illustrates the effect of oil extension with low PCA oils on tin-coupled IBR. While Example 3 shows the effect of oil extension on tin-coupled IBR, one skilled in the art would fully expect based on these results that a similar behavior will be seen for silicon-coupled IBR; the showing of unexpected results is therefore fully commensurate in scope with claim 23 and claim 23 is fully patentable over the cited art.

Claim 24 recites that the solution polymerized elastomer is tin-coupled IBR. Example 3 clearly illustrates the effect of oil extension with low PCA oils on tin-coupled IBR; the showing of unexpected results is therefore fully commensurate in scope with claim 24 and claim 24 is fully patentable over the cited art.

Conclusion

For the foregoing reasons, Applicants urge that the claims are fully patentable over the cited art and respectfully request allowance of all claims.

Respectfully submitted,



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